

## Moulding compositions

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**Inventor:** TORII SHIGEYOSHI

**Applicant:** TOKYO SHIBAURA ELECTRIC CO (JP)

**Classification:**

- **international:** C08L59/00; C08L55/02; C08L77/00; C08L59/00;  
C08L55/00; C08L77/00; (IPC1-7): C08L59/00;  
C08L71/00; C08L77/00

- **european:** C08L59/00

**Application number:** GB19890018378 19890811

**Priority number(s):** JP19880106604U 19880812

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### Abstract of GB2221685

A material for use in the manufacture of movable mechanical elements comprises 20% and 80% by weight of polyacetal resin with the remaining weight percent being polyamide alloy resin or polyether polyamide block copolymers.

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(51) INT CL<sup>4</sup>  
**C08L 59/00 71/00 77/00 // G11B 23/00**

(52) UK CL (Edition J)  
**C3M MXC M100 M104 M104A M112A  
U1S S1384 S1417 S1804 S3045**

(56) Documents cited  
**GB 2210048 A EP 0290761 A2 EP 0179668 A2  
EP 0047529 A2 US 4640949 A US 4098843 A**

(58) Field of search  
**UK CL (Edition J) C3M MB MC ML MXC MXZ**

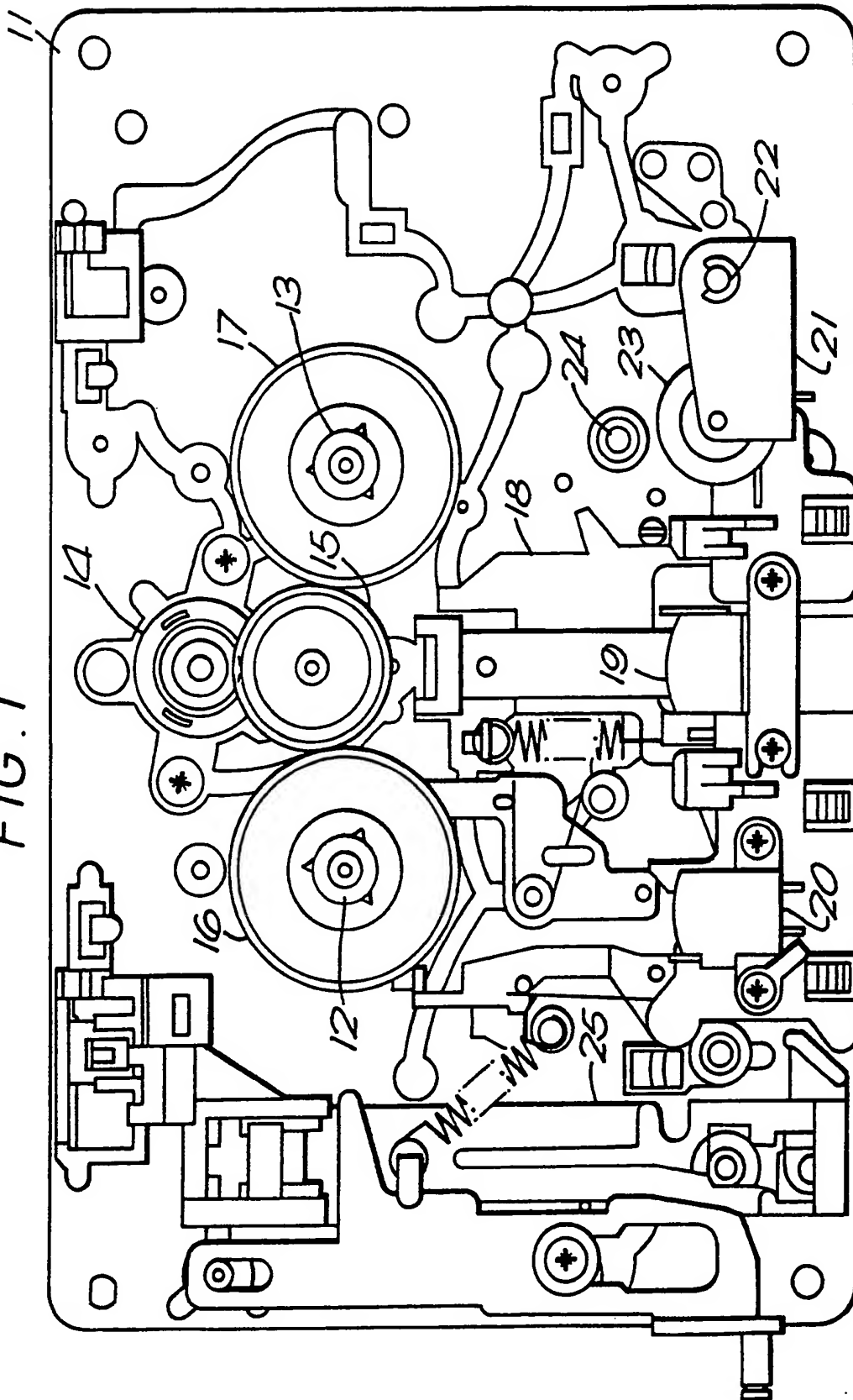
(54) **Moulding compositions**

(57) A material for use in the manufacture of movable mechanical elements comprises 20% and 80% by weight of polyacetal resin with the remaining weight percent being polyamide alloy resin or polyether polyamide block copolymers.

**GB 2 221 685 A**

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FIG. 1



MATERIAL FOR USE IN MANUFACTURING  
MOVABLE MECHANICAL ELEMENTS

5 The present invention relates to material for use in  
the manufacture of movable mechanical elements, and more  
particularly, to material for use in the manufacture of  
movable mechanical elements of audio and/or video  
components.

10 Audio and/or video apparatus, such as an audio tape  
recorder and a video tape recorder, include many movable  
mechanical elements. For example, the movable mechanical  
elements are used as gears, pulleys, levers, etc. for  
driving audio and/or video tapes. Recently, such movable  
mechanical elements are required to be less noisy. That is,  
15 each of two movable mechanical elements which mesh or  
contact with each other are made of material with higher  
noise depression characteristics.

On the other hand, the movable mechanical elements are  
increasingly reduced in size and weight. For reducing the  
20 size and weight the movable mechanical elements are made  
smaller and thinner. Therefore, material for manufacturing  
the movable mechanical elements must have both a better  
sound depressing ability and a strong rigidity.

Conventionally, one of the movable mechanical elements  
25 which mesh or contact with another is made of polyacetal  
resin and the other is made of polyamide resin. In other  
words, two movable mechanical elements which mesh or contact  
with each other are made of different materials.

However, polyacetal resin is a solid material. Thus,  
30 there is a limited possibility for reducing noise.

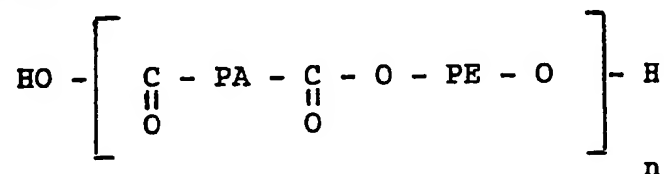
The characteristics (e.g. hardness/softness) of polyamide resins can be altered by alloying the resin to another polymeric component, for instance a polyether. However, the component to which the polyamide is alloyed evaporates as time passes so that the movable mechanical element made of the polyamide alloy resin becomes thin. Thus, after a time two movable mechanical elements made of the polyamide alloy resin which mesh or contact with each other do not mesh well or the clearance between them becomes large and a chattering occurs between them. These drawbacks worsen the operating reliability of the movable mechanical elements.

As described above, conventional materials for use in the manufacture of movable mechanical elements are insufficient for both depressing internal noise and maintaining operating reliability.

The present invention seeks to provide a material for use in the manufacture of movable mechanical elements which has both a better sound depressing ability and a higher operation reliability.

A composition for use in the manufacture of movable mechanical elements according to one aspect of the present invention is comprised of polyacetal resin combined with a polyamide alloy resin. A composition for use in the manufacture of movable mechanical elements according to a second aspect of the present invention is comprised of a polyacetal resin in combination with a polyether block amide resin.

Polyether block amides may be represented by the formula:



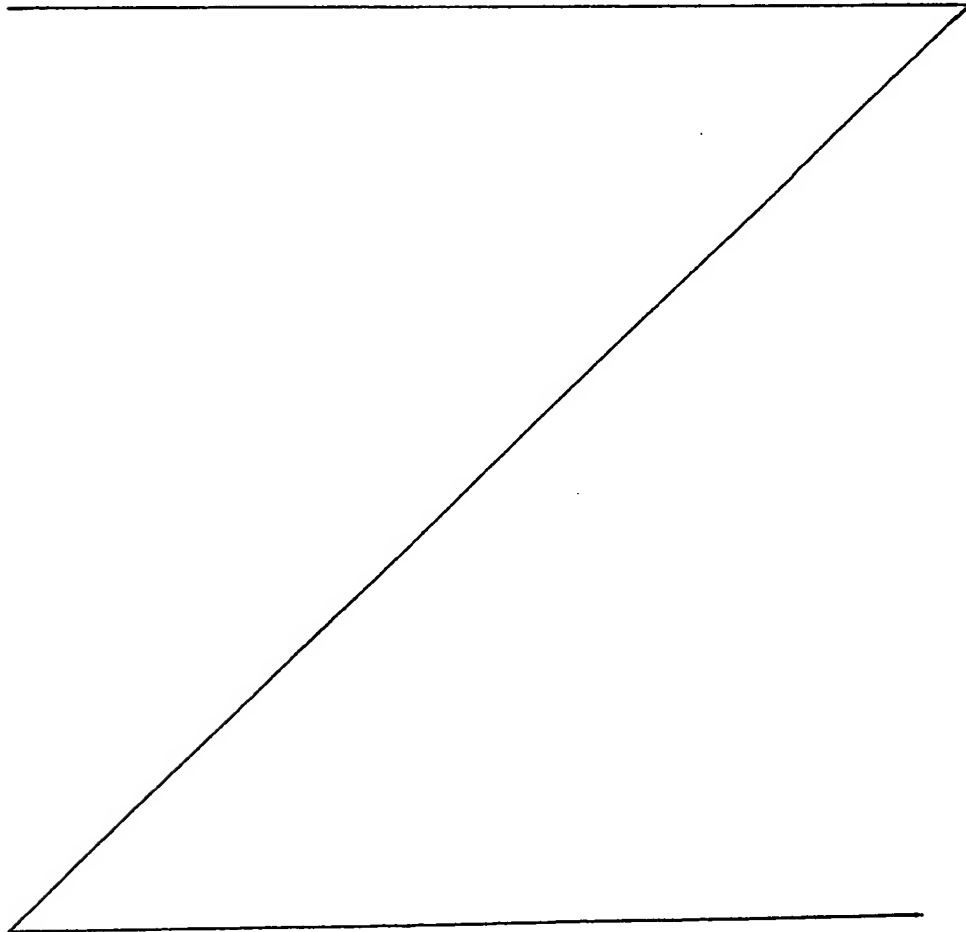
in which PA represents the polyamide segment and PE the

polyether segment. Such copolymers are marketed under the Trade Mark PEBAX by Atochem Inc.. The copolymers may be obtained by polycondensation of a polyether diol, such as PEG (polyethylene glycol) PPG

5 (polypropylene glycol), PTMG (polytetra-methylene glycol), and a di-carboxyl polyamide, e.g. 6PA, 6-6 PA, 11 PA, 12 PA, 4-6 PA, 6-11 PA, 6-12 PA.

For a better understanding of the present invention and the many attendant advantages thereof  
10 reference will be now made by way of example to the accompanying drawing, wherein:

Figure 1 is a plan showing a mechanism of a cassette tape recorder which includes some movable mechanical elements made of the material according to  
15 the present invention.



The present invention will be described in detail below referring to the attached drawing.

According to a first embodiment, polyacetal resin and polyether-ester copolymer which is polyamide alloy resin were mixed with each other at several rates as shown in the following table. Then the materials, i.e., the mixtures of the resins were molded into gears such as idler gear 15, reel driving gears 16 and 17, etc. The gears 15, 16 and 17 were mounted in a mechanism of a cassette tape recorder, as shown in FIGURE 1. Then operating noises of the cassette tape recorder were measured for the several samples of mixing rates.

	Mixing Rate		Noise Level (db)
	Polyacetal Resin	Polyetherester-amide copolymer	
Sample 1	80 wt%	20 wt%	38
Sample 2	60 wt%	40 wt%	37
Sample 3	40 wt%	60 wt%	35
Sample 4	20 wt%	80 wt%	34

As shown in the table, noise levels of the samples 1 to 4 were depressed and when found to be in a range of 38 - 34 db. The noise levels are depressed as much as by 5 - 6 db when compared with a gear made of conventional material such as polyacetal resin only.

The measurement of the noise levels was performed in a dead room with a background noise of 27 db. The operating noise of the tape recorder was picked up by a microphone at a distance of 10 cm from a section around the gears 15, 16 and 17 (see FIGURE 1). Then the noise levels were read from

a sound level meter coupled to the microphone.

If the ratio of the polyetheresteramide copolymer is less than 20 wt%, the rigid polyacetal resin becomes predominant in the material. In this case, the gears made of such a material become insufficient for depressing the operating noise. Further, if the polyetheresteramide copolymer exceeds 80 wt%, although the operating noise can be sufficiently depressed, the mechanical strength of the gears will be worsened. Therefore, the material becomes optimum when it is made of polyacetal resin of between 20 % and 80 % by weight and the remaining weight percent being the polyamide alloy resin.

The polyacetal resin and the polyamide alloy resin are mixed by a conventional double-shaft extruding machine. Then, the mixture is kneaded and pelletized. The double-shaft extruding machine can make the composition of the material uniform. In addition, it is also possible to directly mold the material to the gears etc. by mixing pellets with a conventional tumbling machine.

FIGURE 1 shows the mechanism of the cassette tape recorder which includes some movable mechanical elements made of the material according to the present invention, as described above. In FIGURE 1, a pair of reel spindles 12 and 13 are rotatably mounted on a main chassis 11. A motor 14 is fixed between the reel spindles 12 and 13. The turning force of the motor 14 is selectively transmitted to driving the gears 16 and 17 which are provided coaxially with the reel spindles 12 and 13 through a transmission gear 15. Thus, the reel spindles 12 and 13 are selectively rotated.



Further, a head chassis 18 is movably mounted on the main chassis 11. The head chassis 18 holds a recording and playback head 19 and an erasing head 20. The head chassis 18 moves the recording and playback head 19 and the erasing head 20 to an operating position where the recording and playback head 19 and the erasing head 20 contact with a cassette tape (not shown).

During operation, by interlocking with the movement of the head chassis 18, a pinch lever 21 is rotated around a shaft 22 clockwise in the drawing and a pinch roller 23 is brought in contact with a capstan 24 for pressing the cassette tape to the capstan 24.

Further, an ejection lever 25 is moved upward in the drawing by operation of an ejection key to disconnect the tape cassette from the heads 19 and/or 20.

Here, the material for use in the manufacture of movable mechanical elements according to the present invention is adapted for use in the transmission gear 15, the driving gears 16 and 17, guiding parts of the head chassis 18, the ejection lever 25 and its guiding parts, etc.

As described above, the present invention can provide an extremely preferable material for use in the manufacture of movable mechanical elements.

The foregoing description and the drawings are regarded by the applicant as including a variety of individually inventive concepts, some of which may lie partially or wholly outside the scope of some or all of the following claims. The fact that the applicant has chosen at the time of filing of the present application to restrict the claimed

scope of protection in accordance with the following claims  
is not to be taken as a disclaimer or alternative inventive  
concepts that are included in the contents of the  
application and could be defined by claims differing in  
5 scope from the following claims, which different claims may  
be adopted subsequently during prosecution, for example for  
the purposes of a divisional application.

CLAIMS

1. A composition for use in the manufacture of movable mechanical elements wherein the composition comprises a polyacetal resin combined with a polyamide alloy resin.

2. A composition according to claim 1, wherein the polyacetal resin is present in an amount of between 20% and 80% by weight in the composition with the remaining weight percent substantially consisting of polyamide alloy resin.

3. A composition for use in the manufacture of movable mechanical elements wherein the composition comprises a polyacetal resin in combination with a polyether block amide resin.

4. A composition according to claim 3, wherein the polyacetal resin is present in an amount of between 20% and 80% by weight in the composition with the remaining weight percent substantially consisting of the polyether block amide resin.

5. A mechanical element formed from a composition as claimed in any one of the preceding claims.

6. A method for reducing the internal noise caused by movable mechanical elements characterized by manufacturing these movable mechanical elements from a composition as claimed in any one of claims 1 to 4.

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(74) Agent and/or Address for Service  
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(51) INT CL<sup>4</sup>  
**C08L 59/00 71/00 77/00 // G11B 23/00**

(52) UK CL (Edition J)  
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(56) Documents cited  
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(58) Field of search  
**UK CL (Edition J) C3M MB MC ML MXC MXZ**

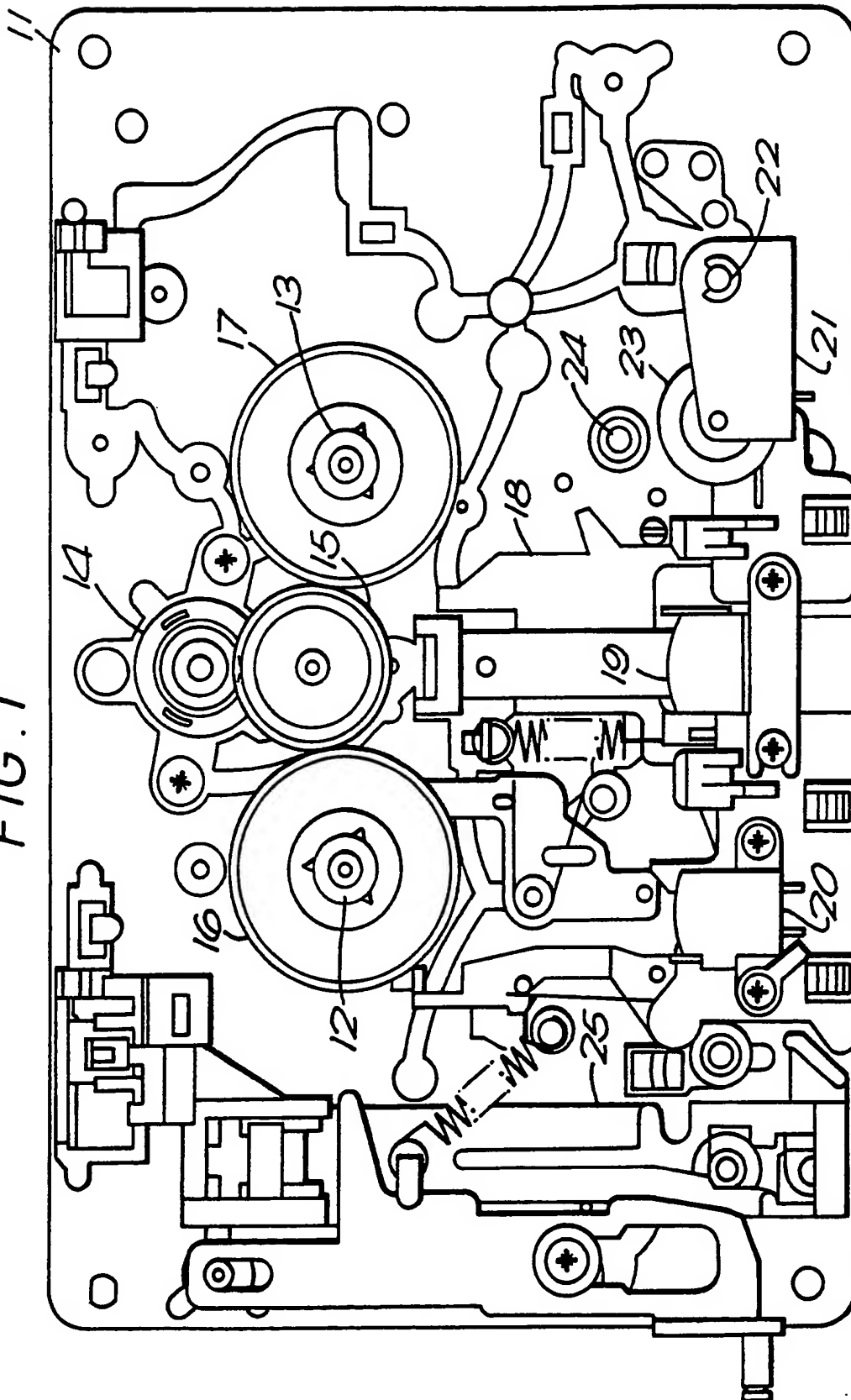
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FIG. 1



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recorder and a video tape recorder, include many movable  
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driving audio and/or video tapes. Recently, such movable  
mechanical elements are required to be less noisy. That is,  
15       each of two movable mechanical elements which mesh or  
contact with each other are made of material with higher  
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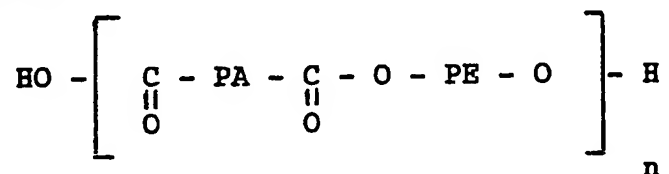
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Polyether block amides may be represented by the formula:

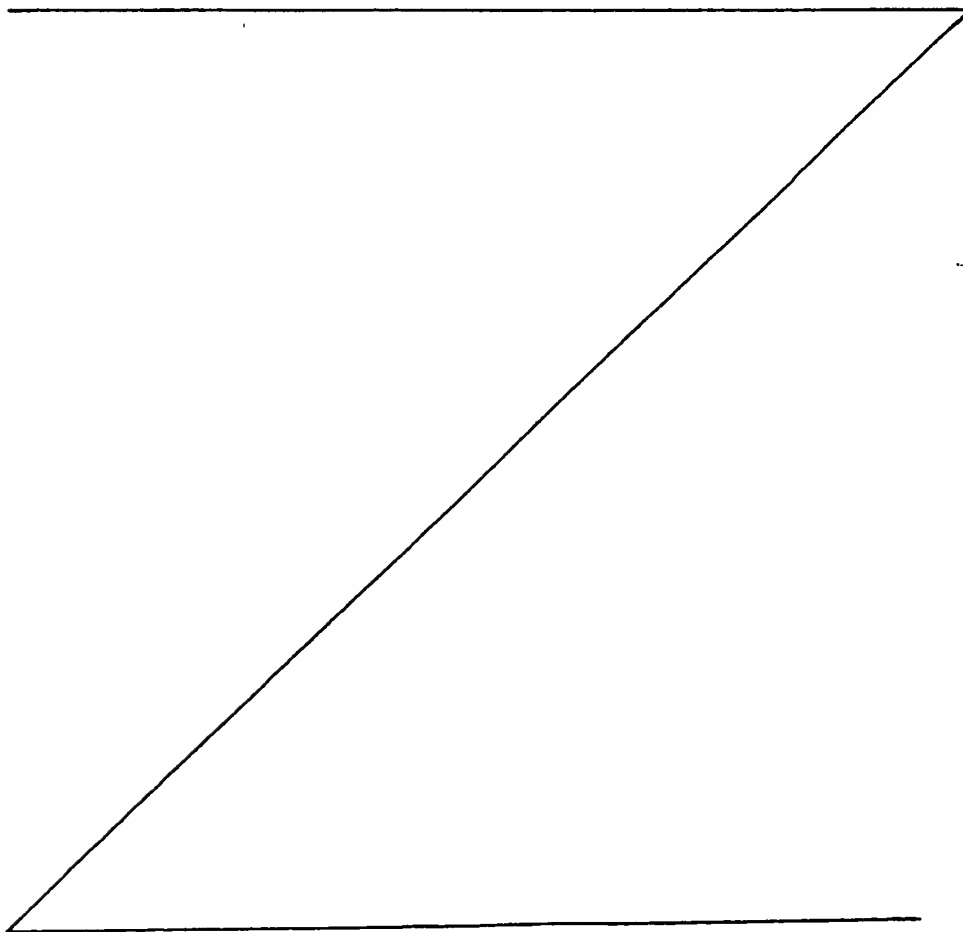


in which PA represents the polyamide segment and PE the

polyether segment. Such copolymers are marketed under the Trade Mark PEBAX by Atochem Inc.. The copolymers may be obtained by polycondensation of a polyether diol, such as PEG (polyethylene glycol) PPG (polypropylene glycol), PTMG (polytetra-methylene glycol), and a di-carboxyl polyamide, e.g. 6PA, 6-6 PA, 11 PA, 12 PA, 4-6 PA, 6-11 PA, 6-12 PA.

For a better understanding of the present invention and the many attendant advantages thereof reference will be now made by way of example to the accompanying drawing, wherein:

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As shown in the table, noise levels of the samples 1 to 4 were depressed and when found to be in a range of 38 - 34 db. The noise levels are depressed as much as by 5 - 6 db when compared with a gear made of conventional material such as polyacetal resin only.

The measurement of the noise levels was performed in a dead room with a background noise of 27 db. The operating noise of the tape recorder was picked up by a microphone at a distance of 10 cm from a section around the gears 15, 16 and 17 (see FIGURE 1). Then the noise levels were read from

a sound level meter coupled to the microphone.

If the ratio of the polyetheresteramide copolymer is less than 20 wt%, the rigid polyacetal resin becomes predominant in the material. In this case, the gears made of such a material become insufficient for depressing the operating noise. Further, if the polyetheresteramide copolymer exceeds 80 wt%, although the operating noise can be sufficiently depressed, the mechanical strength of the gears will be worsened. Therefore, the material becomes optimum when it is made of polyacetal resin of between 20 % and 80 % by weight and the remaining weight percent being the polyamide alloy resin.

The polyacetal resin and the polyamide alloy resin are mixed by a conventional double-shaft extruding machine. Then, the mixture is kneaded and pelletized. The double-shaft extruding machine can make the composition of the material uniform. In addition, it is also possible to directly mold the material to the gears etc. by mixing pellets with a conventional tumbling machine.

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Further, a head chassis 18 is movably mounted on the main chassis 11. The head chassis 18 holds a recording and playback head 19 and an erasing head 20. The head chassis 18 moves the recording and playback head 19 and the erasing head 20 to an operating position where the recording and playback head 19 and the erasing head 20 contact with a cassette tape (not shown).

During operation, by interlocking with the movement of the head chassis 18, a pinch lever 21 is rotated around a shaft 22 clockwise in the drawing and a pinch roller 23 is brought in contact with a capstan 24 for pressing the cassette tape to the capstan 24.

Further, an ejection lever 25 is moved upward in the drawing by operation of an ejection key to disconnect the tape cassette from the heads 19 and/or 20.

Here, the material for use in the manufacture of movable mechanical elements according to the present invention is adapted for use in the transmission gear 15, the driving gears 16 and 17, guiding parts of the head chassis 18, the ejection lever 25 and its guiding parts, etc.

As described above, the present invention can provide an extremely preferable material for use in the manufacture of movable mechanical elements.

The foregoing description and the drawings are regarded by the applicant as including a variety of individually inventive concepts, some of which may lie partially or wholly outside the scope of some or all of the following claims. The fact that the applicant has chosen at the time of filing of the present application to restrict the claimed

scope of protection in accordance with the following claims  
is not to be taken as a disclaimer or alternative inventive  
concepts that are included in the contents of the  
application and could be defined by claims differing in  
5 scope from the following claims, which different claims may  
be adopted subsequently during prosecution, for example for  
the purposes of a divisional application.

CLAIMS

1. A composition for use in the manufacture of movable mechanical elements wherein the composition comprises a polyacetal resin combined with a polyamide alloy resin.  
5
2. A composition according to claim 1, wherein the polyacetal resin is present in an amount of between 20% and 80% by weight in the composition with the remaining weight percent substantially consisting of polyamide alloy resin.  
10
3. A composition for use in the manufacture of movable mechanical elements wherein the composition comprises a polyacetal resin in combination with a polyether block amide resin.
- 15 4. A composition according to claim 3, wherein the polyacetal resin is present in an amount of between 20% and 80% by weight in the composition with the remaining weight percent substantially consisting of the polyether block amide resin.
- 20 5. A mechanical element formed from a composition as claimed in any one of the preceding claims.
- 25 6. A method for reducing the internal noise caused by movable mechanical elements characterized by manufacturing these movable mechanical elements from a composition as claimed in any one of claims 1 to 4.